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he had been able to cover nearly 300 yards. He is now at work on a four-horse power oil engine, to weigh about 40 pounds, which he intends to fit together with a five-foot screw propeller to one of these machines; he hopes then to have a genuine flying machine. Captain Baden-Powell described an aluminum balloon, fitted with a Daimler oil-motor, which had recently been tried at Berlin with somewhat qualified success, and after a few remarks from the chairman on the military aspects of flying machines, the proceedings terminated with a vote of thanks to those who had brought forward exhibits.

UNIVERSITY AND EDUCATIONAL NEWS.

PRESIDENT HARPER says in his twenty-first quarterly statement that it is the custom of the Board of Trustees to arrange for the expenditures of a particular year six months before the beginning of that year. In accordance with this custom the Trustees, on December 29th, voted the budget for the year beginning July 1, 1898. The assured income of the University from all sources was estimated at \$529,000. In addition to this amount the founder of the University, Mr. Rockefeller, has been kind enough to designate, under certain conditions, the sum of \$200,000, making in all \$729,000. The expenditures of the various divisions of the University and of the various departments have been adjusted to this estimated income. The sum of \$25,000 has been set apart as a contingent fund and the remainder is distributed as follows:

Administration and General Expenses, ..	\$72,875
Faculty of Arts, Literature and Science, ..	347,767
The Divinity School,	49,516
The Morgan Park Academy,	37,120
University Extension Division,	41,064
Libraries, Laboratories and Museums, ..	44,615
Printing and Publishing,	41,560
Physical Culture,	7,500
Affiliated Work,	3,000
Buildings and Grounds,	59,425

THE number of graduate students in arts and science in several leading universities are given by the *Harvard Graduates' Magazine* as follows: Harvard, 268; Yale, 254; Johns Hopkins, 220, and Columbia, 207. The number at Chicago appears from President Harper's recent state-

ment to be larger than in any other American university, namely, 324, of which 202 are men and 122 are women.

DURING the present winter semester the registration of regular students in Berlin University amounts to 5,921. This is the largest registration in the history of the University, being 400 in excess of last winter.

PROFESSOR JAMES E. RUSSELL, of the department of Education in the Teachers' College, New York, has been appointed Dean of the College and will, with Dr. F. S. Baker, of the department of English, represent the College on the Council of Columbia University.

THE Academy of Sciences, Paris, has recommended M. C. Chatelier, professor of chemistry in the School of Mines, and M. Joannis, lecturer at the Sorbonne, as candidates for the chair of mineralogical chemistry in the Collège de France, vacant by the death of M. Schützenberger.

M. GUIART has been given charge of the practical work in natural history under the Faculty of Medicine in the University of Paris.

MR. ALFRED HOPKINS, Q.C., M.P., has been elected Principal of Owens College, Manchester, in succession to Dr. Ward, resigned. Mr. Hopkins has announced his attention of retiring from Parliament.

DR. JULIUS ISTVÁNYFY has been appointed professor of botany in the University of Klausenburg, and Dr. Alexander Mágocsy-Dietz associate professor of botany in the University of Budapest. Dr. Ambronn and Dr. Rhumbler, docents in astronomy and zoology in the University of Göttingen, have been promoted to professorships. M. Benard has been appointed assistant in physics at the Collège de France, succeeding M. Maurain.

DISCUSSION AND CORRESPONDENCE.

CLIMATIC CONTRASTS ALONG THE OROYA RAILWAY.

TO THE EDITOR OF SCIENCE: Much has been written concerning the wonderful engineering necessary in order to construct the Oroya Railway, and concerning the scenery along its line, and every one is more or less

familiar with the main facts in the history of this, 'the highest railway in the world.' There is, however, one feature which the traveller who makes the trip from Lima to Oroya, over this wonderful road, cannot fail to notice, and yet which has scarcely been noticed in previous accounts. This concerns the climatic contrasts that are exhibited between the beginning of the line at Callao and its terminus at Oroya, 12,178 feet above sea level. The writer was so struck with these climatic changes during a recent trip over the railroad that he is tempted to send a hurried note concerning them to SCIENCE.

There is nowhere else in the world an opportunity like that permanently afforded by the Oroya Railway of travelling from sea level to an altitude of nearly 16,000 feet in eight hours in a comfortable railway carriage. Many tourists make the great mistake of going only part of the distance to Oroya, and they thus lose some of the most striking features in the climatic belts through which the road passes. Starting from sea level at Callao, the road runs through Lima up the fertile valley of the Rimac, where sugar cane and cotton growing on all sides recall the sugar and cotton plantations of our own Southern States, and bear witness to the genial climatic conditions which here prevail. The contrast, in this section, between the dry and barren hills above the valley and the fertile valley bottom itself, where the lack of rainfall is made up for by irrigation, is most striking.

Chosica, 2,800 feet above sea level, is the point at which the railroad was left and mules were taken in making the ascent of Mt. Harvard, occupied by Professor S. I. Bailey and his party in 1890 as a temporary station, before Arequipa was selected as the permanent site of the Southern Station of the Harvard College Observatory. Mt. Harvard, 6,600 feet above sea level, situated midway between the belt occupied by the 'coast cloud' and a cloudy and rainy region further inland, offered favorable opportunities for astronomical work, but was replaced by Arequipa, where the conditions are still more favorable.

Further up the line, at San Bartholomé, 4,959 feet in elevation, there comes a small belt of

country where sugar cane and cotton no longer grow, but where fruit trees thrive. Bananas, apricots, limes, *chirimoyas*, *paltas* and other fruits are offered for sale in great quantities at this station, and are also sent down to the Lima market. San Bartholomé is also known—in this case unfavorably—as the chief seat of the disease known as *verrugas*, which, although not yet carefully studied in this region in connection with its dependence upon meteorological conditions, would seem, according to information given the writer, to be closely related to these conditions. *Verrugas*, which appears to be a species of blood poisoning, is usually less fatal to the natives of the region than to foreigners. During the construction of the railroad at this point a special hospital had to be built to accommodate the engineers and laborers, who fell victims to the disease. *Verrugas* is generally believed by the natives here to be milder and less prevalent in years when there are few cloudbursts, and more common and more severe in years of many cloudbursts. The disease is always most prevalent after the rainy season has begun.

In this region some rain is said to fall every year on the mountains, but the annual rainfall is reported to be very small, indeed, until above Matucana (7,788 ft.), where the increasing elevation provokes increased precipitation. Cloudbursts, or *huaicos*, as they are here called, occur anywhere on the mountains, at intervals of a few or of many years. These *huaicos*, which seem to be similar in every way to the cloudbursts of our southwestern country, do great damage to the railroad line, especially to the bridges and embankments across the (usually) dry ravines, or *quebradas*. They come very suddenly, and bring down great quantities of rocks and sand from the mountain sides. It was a *huaico* of this kind that carried away the famous Verrugas bridge a few years ago. Landslides are not uncommon in connection with the *huaicos*. A rainy season here comes from December to April. At Casapalca (13,606 ft.) the rain falls mostly in the afternoon, and snow, when it falls, comes usually late in the afternoon. The rain is said to begin earlier and earlier in the day as the rainy season comes on, this apparently being the result of the increasing activity of convectional

ascent as the sun comes more nearly over this parallel of latitude. There is a common belief at Casapalca that there is less snowfall at that town than in former years, and a greater number of *huaicos*, but this, if true, is undoubtedly only another case of a periodic change in climatic conditions, which may last a few years and will then be followed by some years of the reversed conditions.

Mention has been made of the change from the sugar and cotton belt to the fruit belt. In ascending the valley from San Bartholomé the fruit district is soon left behind, and the San Mateo (10,534 ft.) is the center of a region singularly adapted to the growth of potatoes. Here the mountain sides are covered with terraces, most of them built in very ancient times, and potatoes are grown to considerable altitudes above the valley bottom. The increasing rainfall in this region results in a considerable growth of grass and some low shrubs on the mountain sides, whereas nearer the sea level, as above noted, the slopes are bare, and farther up the snow lies on the mountain summits throughout the year. On his journey over the Oroya the writer encountered the first rain noted during the trip at 3 p. m., at an altitude of about 13,000 feet above sea level, and another shower came at 4 p. m., at an altitude of over 14,000 feet.

At the Galera Tunnel, 15,665 feet, the highest point reached by any railroad in the world, considerable snow fields were seen at about the same height above the sea as that of the tunnel, and isolated patches of snow were met with somewhat below that elevation. At this point any cultivation of the ground is, of course, out of the question. From the Galera the descent is rapid down the grass-covered slopes of the mountain into the valley in which Oroya is situated, and here again we reach a climatic zone where it is possible to raise potatoes and other farm products. One can thus travel by the Oroya Railway from fields of sugar-cane and cotton, through a belt where fruit grows most luxuriantly, and up higher to a district famous for its potatoes, until, after winding around slopes and through tunnels, at an altitude where nothing but grass grows, the snow line is reached, and a descent is made to a region

where the rigorous climate of 16,000 feet is replaced by those more genial conditions which favor the raising of crops. This whole succession of climates can be passed through in the short space of ten hours, and it is this feature of the Oroya road which it seems to the writer has not been sufficiently emphasized. The climatic lesson which such a trip teaches is one which is well worth learning, even at the risk of a touch of *soroche*, or mountain sickness, which comparatively few persons escape at the highest part of the road.

A rather interesting industry, which was distinctly the result of climatic conditions, was attempted a few years ago in connection with the snow fields on the mountains above Lima. The presence of these large masses of snow and ice in close proximity to the railroad led to the adoption of a scheme to transport these products of the climate to Lima, where they were to be sold to the inhabitants as ice is sold in our own country. A beginning was made, and some ice was thus taken to the city, but there were certain legal and pecuniary complications in the way, and the enterprise had to be abandoned. A reminder of this unsuccessful venture is still to be seen on the list of freight rates from Oroya to Lima, posted at the railway station in Oroya. On this list, together with the rates for the transportation of freight of various kinds, the traveller may see how much it costs to send *snow* from Oroya to the capital. In Quito the sale of snow and ice brought to the city by the Indians from the high mountains in the vicinity furnishes a similar illustration of the climatic control over human occupations, one of the most important, as it is one of the most striking, subdivisions of the subject of anthropo-climatology.

The climatic contrasts which are exhibited along the Oroya afford an excellent illustration of the variety of climates found in Peru by reason of its high mountains and its geographical position. We learn from Prescott that the Incas were well aware of the differences in the climates of various parts of Peru, and that they were careful to study the climatic conditions to which the tribes they conquered had been accustomed. In transferring, as was often their custom, newly-conquered subjects from their

own district to some other portion of the empire, the Incas made it a point never to oblige people accustomed to a high altitude to live at sea-level, nor to make those who were used to living at a low altitude live far above sea-level. In every case the transfers were made to districts where the climatic conditions were as nearly as possible the same as those to which the conquered people had become accustomed. One of the most interesting contrasts in the climates of Peru is seen in the difference between the desert costal strip of the provinces bordering on the Pacific and the forested Amazonian provinces in the northeast. In the former the dry climate prevents vegetable growth, except where man has provided irrigation, and there must be a constant struggle against Nature in order that anything green may grow. In the well-watered Amazonian provinces, on the other hand, vegetation is altogether too abundant, and man must here struggle to keep down what Nature produces too freely. In fact, the exuberance of the vegetation is such as to interfere with the habitability of the region, for almost as soon as a clearing is made in the forests it is again overgrown. In the rainy provinces, therefore, habitability is almost precluded by the superabundance of vegetation, while in the barren desert strip man can only live where his own labor has provided a water supply sufficient for the needs of vegetation. The contrast is a striking one.

R. DEC. WARD.

LIMA, PERU, December 27, 1897.

AN INTERESTING MONSTROSITY.

My attention was recently called to the monstrosity pictured in the enclosed photograph. It is a cock, of no pure breed, though carrying some Plymouth Rock blood, having no signs of spurs upon the tarsi, but with well developed ones upon the head, on either side of the comb, just above the eyes. These spurs, neither of which is quite normal in shape, are symmetrically placed, and have every appearance of horns. The right spur, which is less malformed than its mate, is fifteen-sixteenths of an inch in length from its perforation of the skin, and about three-sixteenths of an inch at

that point, tapering somewhat unequally to a blunted point, the whole curved so as to somewhat resemble the horn of a Texas steer.

The left spur, which in diameter and length would be nearly identical with the right, is bent forward so as to form a nearly complete circle, approximately one-half inch in diameter, the point of the spur being in contact with the base of the comb. Both of the spurs are entirely disconnected with the bony structure of the skull, being attached only to the skin and easily movable in all directions.

I could not ascertain from the owner of the cock, in whose possession it had been but a short time, whether this looseness of attachment was congenital or had been brought about by contact with the coop or by fighting.

What makes this specimen extremely interesting is the fact that it is neither a case of dichotomy nor of supernumerary parts nor of atavism, but one in which the normal part is found in an abnormal position without any vestige of representation in its usual place.

In the limited amount of material at my command, I have been unable to find any accounts of cases in many respects similar to this, although Sutton, in his 'Evolution and Disease' (Contemporary Science Series), mentions the successful transplanting (artificially) of the spurs of cocks to the excised comb. I am awaiting with interest the result of interbreeding this specimen, in the hope that more of its peculiar kind may be secured, from which a fertile variety of monstrosities may be obtained.

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CORRECTION.

OBJECTION having been made to my use of the term 'respiration' in the article 'Some Considerations upon the Functions of Stomata' in SCIENCE, January 7, 1898, page 15, second column, line 12, I wish to substitute for it the expression 'the passage of gases.' Plant physiologists, for very good reasons, wish to restrict 'respiration' to the gaseous exchange which has to do with the catabolic activities of living cells, excluding that exchange taking place in those anabolic activities (known as photosyntax)